

5 TITLE: TRANSPORT DEVICE FOR ELONGATE MEAT
PRODUCTS AND METHOD FOR COMPENSATING
LENGTH CHANGES IN A DISPLACING MEMBER

CROSS REFERENCE TO RELATED APPLICATION

10 This application is a continuation of U.S. Provisional
Serial No. 60/409,853 filed September 11, 2002 which is based
upon Dutch application No. 1021316 filed August 22, 2002.

FIELD OF THE INVENTION

15 The invention relates to a transport device for elongate
meat products which are subjected to a processing, comprising
at least one endless displacing member for advancing product
carriers, which displacing member is advanced in a frame by
means of a drive. The invention also relates to a method for
20 compensating length changes in a displacing member forming
part of such a transport device for elongate meat products.

BACKGROUND OF THE INVENTION

The processing of elongate meat products while they are
25 being displaced in a transport device is known. That use is
herein made of an endless displacing member, such as for
instance a conveyor belt or chain which is driven using a
motor, is likewise known. Reference is made in this respect
to, among others, International patent application WO
30 99/13729, wherein the problem of the relatively heavy loading
of the displacing member is partly resolved by providing
guides with which the product carrier is supported in a
manner other than by the displacing member. Despite the
invention described in this document, it remains a problem to
35 manufacture transport devices of a greater length. In the
International patent application a solution for transport
over greater length is presented by providing an integrated

5 transport device with at least two separate transport devices connecting onto each other. Placed between the separate transport devices is a transferring means with which the elongate meat products can be transferred from a first transport device to a second transport device. However, the
10 presence of a transferring means has considerable drawbacks, such as, among others, the possibility of failure or other problems during transfer. In addition, a transferring means is bulky and expensive.

U.S. Patent No. 6,086,469 describes a method and device
15 for suspended transport of strands of sausage. A horizontally disposed endless conveyor is provided with hooks from which the strands can be suspended in order to transport the strands from a loading station along a first section of the transport path to a processing station such as a smoking room. From the processing station the transport path leads back to the loading station by means of a second section. The first and the second sections do not herein run symmetrically. Also described is that a motor for moving the conveyor can be supported by a plurality of support motors,
20 in order to thus reduce the tensions in the chain. The suspended transport of elongate meat products such as strands of sausage differs expressly from lying transport of elongate meat products; wherein a reduction in the volume of the conveyor is of much more significance, partly due to the fact
25 that it must usually be possible to position parallel one above the other a plurality of parts of the transport path which run more or less parallel to each other

The present invention has for its object to furnish provisions with which a transport device for lying transport
35 of elongate meat products can be realized of very great length (for instance lengths of more than 100 metres), with only one endless displacing member, without this displacing

5 member having to take an excessively heavy form and without
the necessary presence of a complex measuring and control
mechanism to make the transport device function.

A further object of this invention is to give the
conveyor, for instance a chain, a relatively heavy form, so
10 that fewer problematic length changes of the conveyor will
occur than in a transport device.

SUMMARY OF THE INVENTION

The invention provides for this purpose a transport
15 device of the type stated in the preamble, characterized in
that the endless displacing member is driven at least at two
placed-apart positions and tensioning means for the
displacing member are placed between the drives. The
displacing member will be loaded less heavily locally at the
20 drive when a plurality of drives engage on the displacing
member at placed-apart positions. This makes it possible to
limit the maximum load on the displacing member, even in the
case of extremely long displacing members (theoretically
endlessly long), which has the advantage that relatively long
25 (more than 100 or 50 metres) displacing members can also take
a structurally light form. In the case of displacing members
of a greater length problematic length changes can occur, for
instance as a result of wear, temperature changes, or varying
loads. Tensioning means are provided to enable these changes
30 in the length of the displacing member to be compensated.

In a preferred embodiment of the transport device the
tensioning means are provided with detecting means for
monitoring the functioning of the tensioning means, and the
detecting means are connected to an adjacent drive along the
35 displacing member for controlling the drive subject to the
functioning of the tensioning means. When local tensioning
means must compensate relatively large length changes of the

5 displacing member, these length changes can approximate the
limits of the working range of the tensioning means. When
other tensioning means have not yet reached the limits of the
control range, or when the length of the displacing member is
deliberately changed (for instance manually shortened or
10 lengthened), it is advantageous when at least a part of the
compensated length change of specific tensioning means is
transmitted to other tensioning means or to the location
where the deliberate length change takes place. This becomes
possible without a complex central control when the detecting
15 means of determined tensioning means are coupled to a nearby
drive (located before or after the tensioning means in
transport direction) such that the operation of the drive is
influenced when predetermined compensation values are
reached. Only a coupling of tensioning means to a single
20 drive is a technically simple solution which is not very
susceptible to malfunction and which does not have to be
expensive. In a specific preferred variant the tensioning
means are connected to the subsequent drive in the direction
of transport of the displacing member. By causing the
25 subsequent drive to operate in accelerated respectively
decelerated manner the length variations can be transmitted
in forward direction.

In a specific preferred variant the transport device is
provided with a central control of the drives, to which
30 central control are connected the detecting means of the
tensioning means. Although the complexity of the transport
device is increased with such a central control, the
adjustment options also increase.

The tensioning means preferably comprise a guide
35 displaceable under bias for the displacing member, and the
position of the displaceable guide can preferably be detected
by means of a sensor. The guide can for instance be formed

5 by a reversing roller or a (chain) wheel pressing against the
displacing member with a determined force. When the force
exerted on the displacing member by the displaceable guide is
held substantially constant, the guide will displace subject
to the length changes occurring locally in the displacing
10 member. Such a construction can be realized very simply. A
simple optical sensor with little susceptibility to
disturbance can for instance be applied as sensor.

The drying of semi-manufactures for dry sausage, not
manufactured by means of co-extrusion, still takes place
15 today in suspended state. A plurality of strands not yet
mutually separated are herein suspended from rods or bars.
Meat products manufactured by means of extrusion (including
sausages) are dried on racks. The necessity of using racks
lay in the fact that the elongate meat products, in already
20 shortened form, had to remain in a drying room for a longer
period of time (more than twenty-four hours), which would
necessitate a transport device with a length which could not
be realized economically. The present invention however
makes it possible to provide, at a competitive price, a
25 transport device which is also sufficiently long for this
application. For this purpose the present transport device
is at least substantially disposed in a climate room.

In a relatively simple embodiment variant of the
transport device which is also not very susceptible to
30 failure, the displacing member is formed by a chain. In
order to limit the volume of the chain as much as possible,
steel with good mechanical properties (a high material
strength is particularly important) is preferably used. Even
when the choice of material for the chain has the lesser
35 property that the chain is not sufficiently corrosion-
resistant, it can be advantageous to opt for minimizing the
volume rather than for a greater corrosion resistance.

5 Another important reason for giving preference to a high material strength in the choice of material is that the number of motors driving the chain can hereby be limited. This becomes possible by applying a corrosion-inhibiting agent such as for instance Teflon, for instance by means of
10 optionally continuous vaporizing or spraying on the chain, at a determined location in the transport path.

For the transport of product carriers in a more or less horizontal position it is advantageous when the transport device comprises at least two displacing members running
15 parallel and supporting the product carriers. Favorable results for supporting elongate meat products, such as in particular sausages, can be obtained with product carriers in the form of elongate baskets which are formed at least partly from a material provided with mesh. A very large part of the
20 surface of the products for processing can undergo a surface treatment through the mesh. Particularly envisaged here is the drying of sausages.

For a good support of the displacing member with a limited resistance, it is favorable when the displacing member is displaceable in the frame via rotatable guide means.
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In order to obtain the most compact possible disposition of the transport device with a great length, in a preferred embodiment the displacing member is moved in the frame such
30 that the displacing member contains a plurality of parts running substantially parallel to each other, wherein adjacent parts move in opposite directions. These parts or sections of the transport path can thus be positioned a short distance one above the other, which is possible among other
35 reasons because of the limited volume of the displacing member which can be realized as a result of the present invention. In practice, the drives will normally be formed

5 by motors such as electric motors, hydraulic motors or
pneumatic motors.

The transport device can also be provided with warning
means which are coupled to the detecting means and which are
activated when a determined control limit of the tensioning
10 means is exceeded. The detecting means can thus also be used
to indicate for instance breakage of the displacing member,
or a change in length of the displacing member such that the
length must be adjusted (for instance when the length
increases) by manually removing a part of the displacing
15 member.

The invention also comprises a method of the type stated
in the preamble, comprising the operating steps of a)
monitoring the functioning of the tensioning means by means
of the detecting means, and b) controlling a drive, subject
20 to the monitored functioning of the tensioning means, such
that functioning of the tensioning means falls within a
determined control range. Such a method enables adjustment
of the tension of a displacing member using simple means.
Complex measures such as pulse generators, encoders and
25 complex automated regulating means are unnecessary, although
they can be combined with the present invention if desired.
When the tensioning means exceed a control limit the
detecting means preferably generate a signal, on the basis of
which the length of the displacing member is adjusted. In
30 this manner a more stable operation is created in the
adjustment of the tensioning means; only at moments when this
is actually necessary is the adjustment set into operation,
while during the greater part of the operating time the
tensioning means individually compensate length changes which
35 occur.

5 BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 shows a side view of a transport device according to the invention;

Fig. 2 shows a side view of an end surface of the transport device of Fig. 1;

10 Fig. 3 is a perspective view of a part of the transport device shown in Figs. 1 and 2; and

Fig. 4 shows a detail view of a sensor unit coupled to a displaceable reversing roller for determining the position of the reversing roller.

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DESCRIPTION OF THE EMBODIMENTS OF THE INVENTION

Fig. 1 shows a transport device 1 with a frame 2 in which is arranged an endless chain 3 shown schematically by means of a broken line. Not visible in this figure is a second chain which runs parallel to chain 3 and which runs wholly parallel behind the shown chain 3. Product carriers are suspended between these chains, for which reference is made to figure 3. On both end surfaces 4, 5 of frame 2 are respectively arranged reversing rollers 6, 7, 8 for guiding of chain 3. Reversing rollers 6 on the first end surface 4 are mounted in frame 2 at fixed positions and reversing rollers 7 on the second end surface 5 are also mounted in frame 2 at fixed positions. Reversing rollers 8 are however displaceable in frame 2 such that they are pressed outward with a determined bias (to the right in the figure). For displacing of chain 3 there are there motors 9 placed in frame 2, which engage on chain 3 at placed-apart positions to thus reduce the tensions in chain 3. Also shown schematically are the loading and unloading means 10 for loading transport device 1 with elongate meat products and, after these have passed through the whole transport path, unloading transport device 1. Loading and unloading means 10

5 are disposed at the position of a vertical part 11 of chain
3; this vertical chain part 11 is present to make chain 3
into a closed, endless construction. One of the motors 9
engages on vertical chain part 11. Motors 9 are placed
relative to chain 3 such that, after a determined position on
10 chain 3 passes a motor 9 as this determined position runs
through the transport path, this position first passes a
reversing roller 8 before a subsequent motor 9 is reached.
Transport device 1 makes it possible to accommodate an
endless chain 3 of a considerable length in a relatively
15 compact housing. It hereby becomes possible to also carry
out longer treatment processes as a continuous process, such
as for instance the drying of sausages (for which purpose a
large accommodation capacity for products is required due to
the length of the treatment).

20 Fig. 2 shows end surface 5 of frame 2 of Fig. 1 in more
detail. In addition to the reversing rollers 7 placed in
frame 2 at a fixed position on the second end surface 5 can
also be seen the reversing rollers 8 which are displaceable
along guides 13 by means of pressure cylinders 12. For this
25 purpose a piston rod 14 of pressure cylinder 12 engages on
rotation shaft 15 of displaceable reversing roller 8. In
order to determine the position of displaceable reversing
rollers 8 the piston rod 14 is provided with an arm 16 with
which it drives a sensor unit 17. A sensor unit 17 is shown
30 in more detail in the following figures.

Fig. 3 shows a perspective view of a part of transport
device 1. It can be seen here that chain 3 engages on
product carriers 18 which are manufactured from a material
with a mesh-like structure. Connected to frame 2 is the
35 pressure cylinder 12 which engages with piston rod 14 on
rotation shaft 15 of reversing roller 8 (in this specific
case a chain wheel). It should be apparent that in frame 2 a

5 parallel placed chain advances the non-visible sides of
product carriers 18. This chain (not shown) is also provided
at the corresponding position with a displaceable chain wheel
8 such as the one shown. Arm 16 of piston rod 14 displaces a
strip of material 19 which is embodied such that a surface
10 thereof for detecting encloses an acute angle with the
displacing device of material strip 19. An optical sensor 20
can thus be used to determine the distance to the surface for
detecting of material strip 19. The signal of sensor 20 is
fed back to an adjacently placed motor 9 (not shown) by means
15 of a signal line 21.

Fig. 4 finally shows a detail view of a sensor unit 15
which is coupled to a displaceable reversing roller 8 for
determining the position of reversing roller 8. Arm 16
engages on the displaceable material strip 19. This material
20 strip 19 is provided with a standing edge 22 with a surface
23 which encloses an acute angle with the displacing device
of material strip 19. When material strip 19 is displaced,
the distance between surface 23 and sensor 20 varies, which
can be detected. The material strip 19 is guided by three
25 guide wheels 24.

The operation of the invention, described in the
foregoing summary of the invention, in view of the above
description, makes it clear that this invention will achieve
at least all of its stated objectives.